

REMARKS

For the Examiner's convenience and reference, Applicant's remarks are presented in the order in which the corresponding issues were raised in the Office Action. The distinctions identified and discussed below are presented solely by way of example to illustrate some of the differences between the claimed invention and the cited references. In addition, Applicant requests that the Examiner carefully review any references discussed below to ensure that Applicant's understanding and discussion of the references, if any, is consistent with the Examiner's understanding.

STATUS OF THE SPECIFICATION

The specification stands objected to under 35 USC § 112, first paragraph.

STATUS OF THE CLAIMS

Claims 1-17 and new Claim 89 remain in the case, claims 18-88 having been canceled. Claims 9, 11, and 12 have been withdrawn from consideration. Claims 15-17 stand objected to under 37 CFR 1.75(c). Claims 1-8, 10, and 13-17 stand rejected under 35 USC § 112, first paragraph. Claims 2-8, 10, and 13-17 stand rejected under 35 USC § 112, second paragraph. Claims 1-8, 10, and 13-17 stand rejected under 35 U.S.C. § 102(a). Claims 1-8, 10, 13, and 14 have been amended. New Claim 89 has been added. No new matter has been added.

RESPONSE TO SPECIFICATION OBJECTION UNDER 35 USC § 112, FIRST PARAGRAPH

The specification stands objected to under 35 USC § 112, first paragraph, as failing to comply with the enablement requirement: "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same"

The Manual of Patent Examining Procedure states that

to comply with 35 U.S.C. 112, first paragraph, it is not necessary to "enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment

absent a claim limitation to that effect.” *CFMT, Inc. v. Yieldup Int’l Corp.*, 349 F.3d 1333, 1338, 68 USPQ2d 1940, 1944 (Fed. Cir. 2003) (an invention directed to a general system to improve the cleaning process for semiconductor wafers was enabled by a disclosure showing improvements in the overall system). Detailed procedures for making and using the invention may not be necessary if the description of the invention itself is sufficient to permit those skilled in the art to make and use the invention. (MPEP § 2164)

In the present case, Applicants submit that the disclosure is sufficient under MPEP § 2164 and *CFMT*. As the Examiner surmised (Office Action, p. 5), Applicants are not in physical possession of a perfected, commercially viable embodiment of the invention. However, none of the claims in the case claim a perfected, commercially viable embodiment. Moreover, the Federal Circuit has held that an applicant need not have actually reduced the invention to practice prior to filing. *See Gould v. Quigg*, 822 F.2d 1074, 1078, 3 USPQ2d 1302, 1304 (Fed. Cir. 1987).

Some experimentation will undoubtedly be required for those skilled in the art to make and use the invention. However, Applicants submit that *undue* experimentation will not be required.

The Court of Appeals for the Federal Circuit has held that various factors must be weighed in reaching a conclusion regarding undue experimentation, including the nature of the invention, the level of one of ordinary skill in the art, and the quantity of experimentation needed to make or use the invention in light of the disclosure. *In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988).

In the present case, the level of one of ordinary skill in the art most related to the invention (including, among other fields, the physics of plasma containment) is exceedingly high, generally requiring at a minimum a doctorate-level education and years of post-graduate and professional experience (Exhibit A). The first-named inventor in this case possesses a Ph.D in physics and more than 45 years of theoretical and applied experience in the field. Even with that experience, he nonetheless spent more than 20 years developing the invention and its underlying theory (Exhibit B). The second-named inventor possesses a doctorate degree in plasma physics and several years of experience in the field (Exhibit C).

While the invention's underpinnings in the level of skill in the art are very high, the invention itself (while in several aspects flying in the face of conventional wisdom, including the aspect of plasma quasi-neutrality; *see* Exhibits A, C, and D) is relatively straightforward. For those skilled in the art in light of the disclosure, the present invention, comprising application and adjustment of magnetic fields, currents, and other physical components of the apparatus that have not yet been carried out in the prior art, can be carried out using known components. As partially evidenced by a reference cited by the Examiner (Melendez et al., *Start-Up Without Preionization in NOVILLO Tokamak*,” IEEE Transactions on Plasma Science, Vol. 28, No. 5, Oct. 2000), the use of devices such as tokamaks and magnetic fields within them is well-known in the field of plasma physics, and particularly in the numerous attempts at plasma containment. Applicants themselves are using a tokamak in their ongoing research relating to the invention (Exhibit B). They have employed an assistant versed in conventional construction and use of tokamaks – certainly one who could reasonably be considered skilled in that aspect of the art – for his experience acquired in constructing and adjusting prior art apparatuses.

It is not at all uncommon or unexpected for experimentation to be necessary to carry out inventions disclosed by papers or patents in the relevant field (Exhibit A). Experimentation required to carry out the invention would not be considered *undue* experimentation by those skilled in the art, by the standards set forth in *In re Wands*.

With regard to the Examiner's specific arguments, the Examiner states (Office Action, p. 3, para. 1), “The creation [of] the magnetic field prescribed by the parameter optimization and the assembling of the hardware to employ it is the subject matter of the allegedly novel feature of the invention.” That statement is true to an extent (other parameters not relating directly to the magnetic field are also part of the invention's novelty), but if other parameters are included, the Examiner is correct in her characterization of the invention comprising (to paraphrase slightly) the *combination* of optimized-parameter plasma, magnetic field, current, electric field, *and* hardware in which the prior physical components are employed. The novelty does not lie with the hardware alone. As stated above, Applicants themselves are using an existing tokamak, well-known to those skilled in the art, in their current researches.

To a point, Applicants agree with the Examiner (*id.*) that “the particulars of this device [i.e., the hardware] are not described” Applicants submit that some hardware particulars are indeed described (such as the confinement field generator, further discussed below), but certainly not all. Since much of the hardware is known in the art, it is not necessary to set forth an exhaustive description of it. *See Ex parte Parks*, 30 USPQ2d 1234, 1236 (B.P.A.I. 1994).

The Examiner asserts (Office Action, p. 3, first full paragraph) that the specification is not sufficient to describe Applicants’ confinement field generator (FIG. 18, 366; spec. para. 117) to enable it to perform its intended function. Among other description, however, two separate embodiments of the confinement field generator are described in detail with regard to FIG. 16 (Z pinch) and FIG. 17 (theta pinch) (spec. paras. 114-116). In the case of FIG. 16, the confinement field generator comprises the primary winding 324 and core 326; in the case of FIG. 17, the power supply 346 and primary winding 344. The specification has been amended to further clarify the connection.

The Examiner asserts (Office Action, paragraph straddling pp. 3-4), that the disclosure “does not establish how the parameters are implemented or what aspect of the present invention enables it to succeed in forming smaller confinement volumes where the conventional technology has failed.”

First, a clarification: Applicants do not necessarily base the novelty of the present invention solely on forming *smaller* confinement volumes. An important point of novelty of the present invention is forming *differently sized* confinement volumes for the two components of the plasma, e.g., ions and electrons, due to the applied magnetic field and/or other components described in the specification and as stated in the claims.

The Examiner goes on to state (*id.*) that “the disclosure describes the functioning of the embodiment in terms of the intended result, rather than the structure and the components that comprise it. . . . [T]he disclosure must enable a person skilled in the art to practice the invention without having to design structure not shown to be readily available in the art.” As discussed above, Applicants base the novelty of the invention on the combination of optimized-parameter plasma, magnetic field, current, electric field, as well as some hardware (e.g., the confinement field generators of FIGS. 16 and 17). The novelty does not lie with the hardware alone; an

example hardware setup used as part of the inventive apparatus includes a tokamak, something known and readily available in the art. Applicants submit that the disclosure sufficiently describes all components of the invention not known in the art while properly leaving out detailed and redundant descriptions of components known in the art (*see Ex parte Parks*, 30 USPQ2d 1234, 1236 [B.P.A.I. 1994]), and that the description is therefore sufficient under the statute.

RESPONSE TO CLAIM OBJECTIONS UNDER 37 CFR 1.75(c)

Claims 15-17 stand objected to under 37 CFR 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Applicants agree with the Examiner that the three claims represent the same phenomenon; claims 16 and 17 have therefore been canceled. Applicants submit, however, that Claim 15 further limits Claim 1, on which it depends. Claim 1, as amended, contains the limitation of “a plasma . . . wherein said electrons act as charge carriers in a current established in said plasma” While the electrons continue to act as charge carriers in Claim 15, that claim also contains the element of the ions being charge carriers, with the electrons contributing to the current relatively more than the ions. Thus, Applicants submit that Claim 15 further limits the subject matter of the previous claim under 37 CFR 1.75(c), and is allowable under that section.

RESPONSE TO CLAIM REJECTIONS UNDER 35 U.S.C. § 112, FIRST PARAGRAPH

Claims 1-8, 10, and 13-17 stand rejected under 35 USC § 112, first paragraph, on two grounds (Office Action, pp. 4-5, para. 6 [first ground] and para. 7 [second ground]).

In the first ground, the Examiner asserts (Office Action, p. 4, para. 6) that the claims fail to comply with the enablement requirement as containing subject matter that is not supported by an enabling description.

Applicants submit that, in this rejection, the Examiner has not met her burden of presenting a *prima facie* case of non-enablement of the claims. The only arguments the Examiner asserts in support of the rejection in paragraph 6 (the next section, paragraph 7 on page 5, appears to constitute a different rejection) is a general restatement of the enablement

requirement and the Examiner's belief that the invention is essentially a theoretical concept and that the inventors did not have an operative embodiment of the invention at the time of filing. Applicants submit that such general statements do not present a reasonable basis for rejection, which is required to present a *prima facie* case of non-enablement.

The Examiner states that "[t]he claims contain subject matter which was not described in the specification" in an enabling way, but she does not point out which claim limitations, or even which claims, contain the non-enabling subject matter.

"[A rejection based on non-enablement] can be done by making specific findings of fact, supported by the evidence, and then drawing conclusions based on these findings of fact. For example, doubt may arise about enablement because information is missing about one or more essential parts or relationships between parts which one skilled in the art could not develop without undue experimentation. In such a case, the examiner should specifically identify what information is missing and why one skilled in the art could not supply the information without undue experimentation. . . . [S]pecific technical reasons are *always* required. MPEP 2164.04 (emphasis added)

As stated above, it is, additionally, settled law that an applicant need not have actually reduced the invention to practice prior to filing the application. *See Gould v. Quigg*, 822 F.2d 1074, 1078, 3 USPQ2d 1302, 1304 (Fed. Cir. 1987) ("The mere fact that something has not previously been done clearly is not, in itself, a sufficient basis for rejecting all applications purporting to disclose how to do it."); MPEP 2164.02 ("Compliance with the enablement requirement of 35 U.S.C. 112, first paragraph, does not turn on whether an example is disclosed. An example may be 'working' or 'prophetic.'")

In the second ground of rejection under this section, in paragraph 7 (Office Action, p. 5), the Examiner rejects claims 1-8, 10, and 13-17 under 35 USC § 112, first paragraph, as based on a disclosure which is not enabling, as "components of the confinement field generator critical or essential to the practice of the invention, but not included in the claims are not enabled by the disclosure." Claim 1, upon which the other claims remaining in the case depend, has been amended to include the limitation of a confinement field generator, and it has been shown above that the specification includes enabling description, including two separate embodiments, of such a confinement field generator. With the confinement field generator included in Claim 1, Applicants submit that it is not necessary for enablement purposes to spell out its components in

the claims, since it is the *specification* that must be enabling, not the claims. *See Miles Lab., Inc. v. Shandon Inc.* 997 F. 2d 870, 27 USPQ2d 1123 (Fed. Cir. 1993).

With regard to the remainder of paragraph 7, as discussed above, Applicants base the novelty of the invention on the combination of optimized-parameter plasma, magnetic field, current, electric field, as well as hardware in and around which the other physical components are disposed. The claimed novelty does not lie with the hardware alone. Some prior art confinement field generators may in fact be capable of implementing some of the confinement parameters.

RESPONSE TO CLAIM REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claims 2-8, 10, and 13-17 stand rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention (Office Action, p. 5, para. 9).

Claim 1 was not rejected under this section, but since the Examiner nonetheless argues that it is indefinite, for efficiency's sake Applicants herewith present arguments supporting its definiteness in light of possible future rejections. Claim 1 has been amended to give further detail, replacing the former limitation of the magnetic field "influencing" the electrons. As amended, Claim 1 contains the limitation of "the magnetic field configured to confine the electrons"

The language "substantially more" has been removed.

Applicants submit that Claim 1, as amended, clearly communicates what is meant by "at least a partial separation" between the ions and electrons in the plasma. The electrons are substantially confined within the electron confinement volume, while the ions contain no such limitation and may be distributed throughout the containment volume. This configuration results in at least a partial separation in distributions, since it would be impossible to distribute two species of particles disposed in differing volumes without at least some distribution separation.

With regard to Claims 2-8, the Examiner argues that the language does not clearly set forth the metes and bounds of the claims since the electron skin depth is a variable. Claims 2-8 have been amended to reiterate what is discussed in the specification, i.e., that the electron skin depth is a function of the average particle density – in this case, the average electron density – of

the plasma, with the rest of the electron skin depth equation comprising constants. *See* para. 56 and eq. 10 of the specification. While the electron skin depth will obviously change from one application of the invention to another – given the different plasma amounts, housing sizes, etc., that practitioners may wish to use – the plasma density, and thus the electron skin depth, will be known for each application, giving clear metes and bounds of the claims for each application. Acceptability of claim language under this section depends on whether one skilled in the art would understand what is claimed; claims that include language of degree or relativity are not automatically rendered indefinite. *Seattle Box Co. v. Industrial Crating & Packing, Inc.*, 731 F. 2d 828, 221 USPQ 568, 573-74 (Fed. Cir. 1984).

Claims 2-8 are analogous to the claims at issue in *Orthokinetics, Inc. v. Safety Travel Chairs Inc.*, 806 F. 2d 1565, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986), where a claimed pediatric wheelchair part “dimensioned as to be insertable through the space between the doorframe of an automobile and one of the seats” was upheld as a definite claim limitation. As in the present case, the exact dimensions depended on the specific implementation of the invention. The Federal Circuit noted that the law did not require that all possible lengths corresponding to spaces in all possible automobiles be listed in the patent, let alone the claims. *Id.*

A similar situation exists with regard to the rejection of Claim 14. The Examiner argues that the beta value is dependent on factors not clearly set forth in the claim and that it is defined in terms of “unknowns.” Applicants submit that the claim clearly sets forth the factors upon which the beta value depends, i.e., the average number density, average plasma temperature, and magnetic field strength, all of which are discussed in detail in the specification. (The claim has been amended to limit the temperature factor to the *average* temperature, a well-known and easily determined quantity in the field, as well as to include a second beta value, discussed below.)

Additionally, while they will vary from one application to another given the particular setup of the inventive apparatus, the factors set forth in Claim 14 are far from “unknown,” since they are largely inputs determined by the user, providing the user with clear metes and bounds of the claim. The user determines the average number density of the plasma by using a housing with a known volume and inputting a known quantity of plasma into the housing. The plasma

temperature can also be determined and is known in prior art apparatuses, as it is in the present invention, and the magnetic field strength is determined by the user. These are factors that are commonly known and used in prior art apparatuses (Exhibit A, para. 5). As set forth by the *Orthokinetics* court, precise values corresponding to every possible situation are not required in order to fulfill the definiteness requirement.

The Examiner asserted that there was no antecedent basis for the “operating parameters” of the plasma in Claim 14. The language has been removed.

With regard to Claims 10, 13, and 15-17, the Examiner makes no argument as to their indefiniteness, not mentioning them except to reject them under 35 USC § 112, second paragraph. Applicants submit that the Examiner has not met her required burden of setting out a *prima facie* case with regard to those claims.

RESPONSE TO CLAIM REJECTIONS UNDER 35 U.S.C. § 102(b)

Claims 1-8, 10, and 13-17 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,236,964 to Bass et al. (hereinafter Bass). (The Examiner quotes section 102[a], but states that the rejection is under section 102[b]. Applicants here assume the rejection is under section 102[b]).

In the Office Action (p. 6, para. 11), the Examiner asserts that Bass discloses various features of the present invention as claimed. In particular, the Examiner asserts that Bass discloses a containment volume (Bass FIG. 2A, 14) and an electron confinement volume (Bass FIG. 2A, 14). As claimed in Claim 1, however, Applicants limit the electron confinement volume as “*being smaller than the containment volume*” (Claim 1 has been amended; the language is similar in both the amended and unamended form). Bass clearly does not have that limitation, as its containment volume and electron confinement volume are one and the same, making Claim 1 patentably distinct from Bass.

Bass also does not contain the limitation of Claim 1 of an electron confinement volume wherein the electrons are “substantially magnetically confined” while the ions are not so confined, the ions being contained within the larger containment volume.

In partial response to the Examiner’s points in the first unbulleted paragraph on page 7 of

the Office Action, Claim 1 has been amended to remove the “wherein” and “so as to” clauses, including such clauses relating to the at least “partial separation in distributions in the electrons and ions” and the “electrostatic field disposed in the containment volume resulting from the partial separation in distributions.” Those components are now actively claimed limitations, together with (as the Examiner points out on page 7 of the Office Action) the plasma and magnetic field, rather than suggestions or options for claim limitation as discussed in MPEP 2111.04.

With regard to those limitations, as pointed out above, Bass neither teaches nor suggests separation of ion and electron distributions, only teaching the plasma 14 as a whole. Nor does Bass teach the electrostatic field resulting from the distribution separation. Applicants submit that these two limitations make Claim 1 further patentably distinct and allowable over Bass.

The Examiner asserts that the limitations of the distribution separation and resulting electrostatic field simply describe conventional aspects of other limitations contained in Claim 1. Applicants traverse this assertion, since these limitations are far from conventional. The principle of plasma quasi-neutrality has been a venerable, long-standing principle in plasma physics, dictating that a plasma under the influence of a magnetic field, in aggregate, does *not* undergo a separation in distributions of ions and electrons, and remains electrically neutral on scale much larger than the Debye length (as in the present invention), with substantially no electrostatic field (Exhibits A para. 6, C, and D). As shown, while *individual* charge separation due to an applied magnetic field may be a “mathematical certainty,” as the Examiner asserts, *aggregate* or *bulk* charge separation, as claimed, is not.

Bass uses the magnetohydrodynamic (MHD) equations (calling them “magnetofluidynamic”), equations that are discussed in Exhibit D (Stacey) which uses quasi-neutrality. See Bass col. 18 line 55; col. 12 line 65. In fact, one of the inventors listed on the Bass patent states in Exhibit A that the present invention “is not at all like the device disclosed in the Bass patent,” with different cross-sections, different magnetic field configuration, “and the Bass patent device does not contemplate a charge separation, with attendant electric fields” (Exhibit A, para. 6).

The cases the Examiner cites in this section, *Ex parte Thibault*, 164 USPQ 666, 667 (BD. App. 1969), and *In re Young*, 75 F.2d 996, 26 USPQ 69 (CCPA 1935), are distinguishable from the present case in that Applicants are actively claiming the plasma, magnetic field, and other physical components of the combined apparatus, together with the associated hardware, as the patentable invention, rather than attempting to patent the hardware alone by distinguishing over the prior art through inclusion of other components. Applicants' hardware alone may or may not be patentable. The claims to the present apparatus actively list as limitations the hardware as well as other physical components of the invention; those other physical components, while not as durable as the hardware, are nonetheless real, physical components of the claimed apparatus rather than being "material or article worked on" (MPEP 2115).

For example, the plasma itself must be included in the limitations of Claim 1 in order to satisfy the utility requirement of 35 U.S.C. § 101, since the plasma is the physical component that carries the current; the invention would be inoperable without it. The plasma in this aspect is exactly the same as a common conductive wire, and is no less a physical component and legitimate apparatus claim limitation for being less durable than a wire. Applicants could have chosen to term the plasma in the claims as a "current means" – a common means-plus-function limitation, which could include a hardware component such as a wire – but however it is termed, the current-carrying plasma is necessary for invention utility and cannot be eliminated. Similar analyses apply to the other components claimed.

With regard to the rejection under this section of Claims 2-8, Applicants' electron confinement volume is smaller than the containment volume, as limited in independent Claim 1, and Bass neither teaches nor suggests anything similar, Bass being limited to a containment volume that contains the plasma and nothing more. See Exhibit A. Bass does not disclose a volume configured solely for confinement of electrons, of whatever size. (Applicants note that the electron skin depth is dependent on the electron number density, as the Examiner correctly points out, but not of frequency).

It is true, as the Examiner points out, that differences solely of dimension where "a device having the claimed relative dimensions would not perform differently than the prior art device" are not patentably distinct (Office Action, p. 8, citing *Gardner v. TEC Systems, Inc.*, 725 F.2d

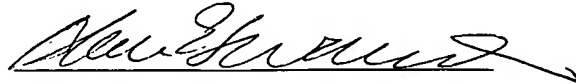
1338, 220 USPQ 777 (Fed. Cir. 1984), *cert denied*, 469 U.S. 830, 225 USPQ 232 (1984). In this case, however, particularly with regard to Claims 7 and 8, the claimed relative dimensions (1-2 and 1.2 electron skin depths, respectively, in those claims) do enable the inventive apparatus to perform differently than prior art devices, Bass included, given that they enable charge separation and provide stable equilibria, factors not contained in Bass. *See* paras. 101-106 and FIGS. 15A-15C. As stated, the equilibria may be most stable when the dimensions are as claimed in Claims 7 and 8, though they may yield sufficient stabilities at the larger ranges included in Claims 2-6.

With regard to the rejection under this section of Claim 14, the Examiner correctly points out that any plasma must have an associated beta value. Claim 14 has been amended to limit Applicants' plasma beta values to ranges suitable for the inventive apparatus, with new Claim 89 further limiting the beta values. The discussion above regarding differences of dimension applies also in this case.

With regard to the rejection of Claim 15 (Claims 16 and 17 having been canceled), in Claim 1 the electrons are the current carriers, saying nothing about the movement or contribution to the current of the ions. Claim 15 further limits the apparatus by including the contribution of the ions.

Applicants therefore submit that the claims remaining in the case are allowable in form and over the prior art. If any impediments to the prompt allowance of the claims can be resolved by a telephone conversation, the Examiner is respectfully requested to contact the undersigned.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Alan Edwards', with a long horizontal flourish extending to the right.

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